AD

AD-E403 719

Technical Report ARWSE-TR-15015

LIGHTWEIGHT TACTICAL CLIENT: A CAPABILITY-BASED APPROACH TO COMMAND POST COMPUTING

Ross D. Arnold

December 2015

U.S. ARMY ARMAMENT RESEARCH, DEVELOPMENT AND ENGINEERING CENTER

Weapons and Software Engineering Center

Picatinny Arsenal, New Jersey

The views, opinions, and/or findings contained in this report are those of the author(s) and should not be construed as an official Department of the Army position, policy, or decision, unless so designated by other documentation.

The citation in this report of the names of commercial firms or commercially available products or services does not constitute official endorsement by or approval of the U.S. Government.

Destroy this report when no longer needed by any method that will prevent disclosure of its contents or reconstruction of the document. Do not return to the originator.

REPORT DOCUMENTATION PAGE		Form Approved OMB No. 0704-01-0188

The public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing the burden to Department of Defense, Washington Headquarters Services Directorate for Information Operations and Reports (0704-0188), 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302. Respondents should be aware that notwithstanding any other provision of law, no person shall be subject to any penalty for failing to comply with a collection of information if it does not display a currently valid OMB control number.
PLEASE DO NOT RETURN YOUR FORM TO THE ABOVE ADDRESS.

1. REPORT DATE (DD-MM-YYYY) December 2015	2. REPORT TYPE Final	3. DATES COVERED (From - To)

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
LIGHTWEIGHT TACTICAL CLIENT: A CAPABILITY-BASED APPROACH TO COMMAND POST COMPUTING	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER

6. AUTHORS	5d. PROJECT NUMBER
Ross D. Arnold	5e. TASK NUMBER
	5f. WORK UNIT NUMBER

7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) U.S. Army ARDEC, WSEC Fire Control Systems & Technology Directorate (RDAR-WSF-M) Picatinny Arsenal, NJ 07806-5000	8. PERFORMING ORGANIZATION REPORT NUMBER

9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES) U.S. Army ARDEC, ESIC Knowledge & Process Management (RDAR-EIK) Picatinny Arsenal, NJ 07806-5000	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S) Technical Report ARWSE-TR-15015

12. DISTRIBUTION/AVAILABILITY STATEMENT

Approved for public release; distribution is unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

The technical terms "thin client" and "light client" are frequently referenced within the U.S. Army as a means by which to describe the future direction of command post computing architecture. However, the tactical capability of fully disconnected operations (a critical Command Post Client requirement) cannot be realized through use of a traditional thin client. It is, therefore, critical to extract key capabilities from the definition of a thin client and propose a new term that is not bound to the thin client terminology. This report opens with two definitions of a thin client: one offered by industry and another by the U.S. Army. The thin client capabilities that meet the needs of a Command Post Client are then extracted from these definitions. These capabilities are paired with tactical capabilities incompatible with thin client architecture. A new term that bundles these capabilities together is proposed: a lightweight tactical client. In order to avoid miscommunication in the future, it is recommended that the term "thin client" be phased out in favor of the new term or an acceptable equivalent.

15. SUBJECT TERMS

Mission command   Software   Battle command   Tactical applications   Thin client   Light client
Thick client   Command post computing environment   Command post client

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON Ross Arnold
a. REPORT U	b. ABSTRACT U	c. THIS PAGE U	SAR	15	19b. TELEPHONE NUMBER (Include area code) (973) 724-8618

Standard Form 298 (Rev. 8/98)
Prescribed by ANSI Std. Z39.18

UNCLASSIFIED

CONTENTS

UNCLASSIFIED

ACKNOWLEDGMENTS

INTRODUCTION

The technical terms "thin client" and "light client" are frequently referenced within the U.S. Army as a means by which to describe the future direction of command post computing architecture – namely, a Command Post Client. However, there appears to be a gap between the technical understanding of the term "thin client" as a software application and the perception of a thin client application from an operational standpoint. For example, a requirement of a Command Post Client (ref. 1) is the capability to operate for an extended period of time (48+ hr) while completely disconnected from a network (ref. 2). However, the technical definition of a thin client does not support this requirement, as a thin client leverages architecture designed for server-side data and business logic processing. This processing requires a persistent network connection to an external server. Once disconnected from the network, a true thin client loses its operational capability (essentially acts as a "dumb terminal"). It is, therefore, critical to understand the specific subset of thin client capabilities required of a Command Post Client. Leveraging this understanding, a Command Post Client can be designed in a way that meets the needs of the Command Post Computing Environment (CPCE) while remaining technically feasible.

THIN CLIENT DEFINITIONS

The U.S. Army Chief Information Officer G6 provides definitions for both thick and thin clients that align well with industry definitions. These definitions are in the following paragraphs, and they are followed by industry definitions. However, neither the U.S. Army's nor industry's definition of a thin client allows the full set of required Command Post Client capabilities.

U.S. Army Definition of Thick and Thin Clients (ref. 3)

Thick Client

Thick clients, also called heavy clients, are full-featured computers that are connected to a network. Unlike thin clients, which lack hard drives and other features, thick clients are functional whether they are connected to a network or not. While a thick client is fully functional without a network connection, it is only a "client" when it is connected to a server. The server may provide the thick client with programs and files that are not stored on the local machine's hard drive. It is not uncommon for workplaces to provide thick clients to their employees. This enables employees to access files on a local server or use the computers offline. When a thick client is disconnected from the network, it is often referred to as a workstation.

Thin Client Terminal

The thin client terminal is an end-user device. The thin client terminal will replace user's current desktop personal computer. End-user devices in Thin/Zero Client Computing rely on network access to backend infrastructure for these functions. These virtual user devices, known as thin or zero client devices, have no (or a limited) local hard drive and require a common access card or secure token to log on and operate. Virtualized client applications, backend servers, and data storage are located in the backend infrastructure.

Industry Definition of Thin Client (ref. 4)

A thin client is a client machine that relies on the server to perform the data processing. Either a dedicated thin client terminal or a regular personal computer (PC) with thin client software is used to send keyboard and mouse input to the server and receive screen output in return. The thin client does not process any data; it processes only the user interface (UI).

There are three ways thin clients are used. The first two are traditional thin clients processing only the UI, and the third is a variation that processes the data.

Shared Services (User Interface Processing)

Using shared terminal services software such as Windows® Terminal Services, Windows® Remote Desktop Services, or Citrix® XenApp, users share the operating system and applications in the server with all other users at thin client stations. Although presented with their own desktop, users do not have the same flexibility as they do with their own PC and are limited to running prescribed applications and simple tasks such as creating folders and shortcuts

Desktop Virtualization (User Interface Processing)

Using products such as VMware Desktop Manager, the Virtual Desktop Infrastructure component in Remote Desktop Services and Citrix® XenDesktop, each user's desktop (operating system and applications) resides in a separate partition in the server called a virtual machine. Users are essentially presented with their own PC, except that it physically resides in a remote server in the datacenter. They can modify the desktop and add applications like they could with their own PC ("fat client").

Browser-based (Data Processing)

This approach uses ordinary PCs connected to the Internet, and applications are executed in the Web browser. Although the user's machine does the data processing, it is thin client computing because the software and data are retrieved from the network. Very little, if anything, is stored locally. If users spend most of their time running Web applications, they are doing thin client computing whether they have a fully loaded PC or not. Figure 1 is a diagram of the thin client architecture described by definition no. 3.
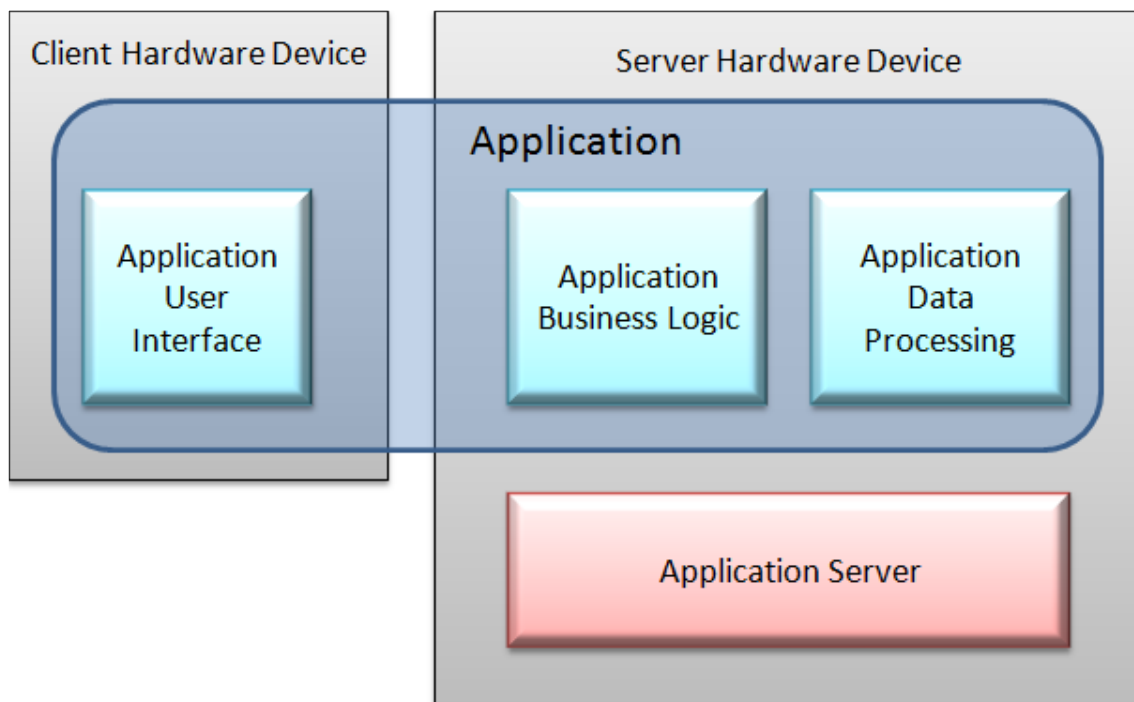

Figure 1
Thin client architecture

CRITICIAL CAPABILITIES

A thin client in the context of command post computing refers to the third industry definition, the browser-based thin client. However, in order to support disconnected operations, the assertion that "very little is stored locally" must be broken.   Long-term disconnected operations require local caching of the application data along with a local repository of business-specific data. Thus, a thin client described by either the U.S. Army or industry definition will not satisfy command post computing requirements.

However, thin clients do possess certain capabilities that provide high value to command post computing. Additionally, the element of human perception associated with the term thin client is highly relevant. The following are the critical capabilities of a Command Post Client extracted from the thin client definition and applied to an operational CPCE. They are divided into two primary categories: accessibility and perception.

Accessibility

- Minimize field service representative (FSR) maintenance footprint
  - Installing and configuring the client should not require FSR support

- Administrative access to client machine not required
  - Lightweight install
    - Install not required or client installed without the use of administrative rights
    - A new user without administrative rights should have the ability to connect a laptop or tablet to the network without the client installed and have the ability to use the client within 10 min or less
  - Network updates
    - When updates are pushed, they can be downloaded and applied via the network by a user without administrative rights

Perception

- Perceived as lightweight in terms of central processing unit (CPU), memory, and bandwidth footprint

- Able to operate on a physically light platform (tablet computer, laptop, phone, etc.)
  - Not restricted to such a platform

- Responsive UI

Note the absence of a requirement to process data on the server side or maintain a persistent connection to a server. In fact, these capabilities do not include any architectural requirements at all. These qualities are all operational and/or perceptive in nature. It is important to note that the responsive UI perception requirement may actually rule out some browser-based solutions and almost definitely rules out most terminal-based thin clients.

LIGHTWEIGHT TACTICAL CLIENT

As the previous qualities do not describe a thin client as defined by the U.S. Army or industry, they require a different term – a lightweight tactical client (LTACC).   Such a client is defined by the following criteria:

Lightweight

Capabilities

- Administrative access not required to install and/or operate client
- One-touch install
- Updates delivered via network

Considerations

- Minimal CPU, random-access memory (RAM), bandwidth footprint
- Responsive UI

Tactical

Capabilities

- Supports continuous operations during disconnected, intermittent, and latent states including fully disconnected operations
- Able to operate on a physically light platform (tablet computer, laptop, phone, etc.); not restricted to such a platform

Note that the lightweight considerations require further definition in order to become suitable for development purposes. The architecture of a LTACC is shown in figure 2.
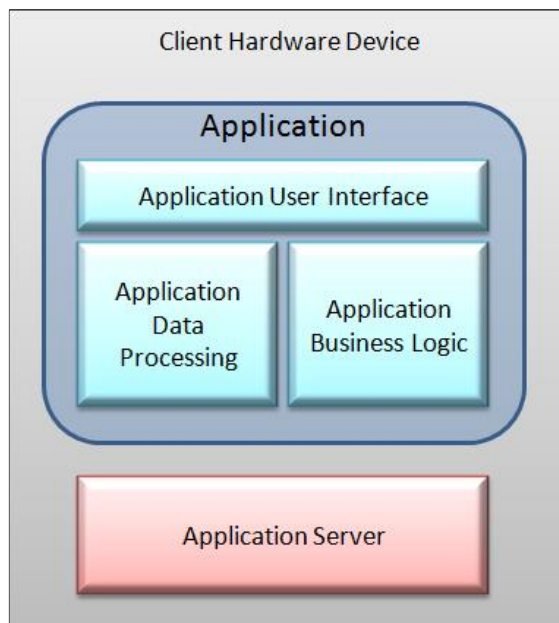

Figure 2
LTACC architecture

A technical option that facilitates disconnected operations is the presence of the application server on the local client machine. This may appear to contradict the "lightweight" nomenclature used in the proposed terminology. However, it should be noted that an application server is extremely lightweight in terms of CPU and RAM usage on most modern machines. The co-location of the application server on the client device is necessary for disconnected operations.

Additionally, when all of these components are placed on the client machine, this diagram resembles a thick client. The term thick client shouldn't be used instead of LTACC, and the thick client terminology should be avoided for similar reasons as the thin client terminology. A LTACC contains a unique set of properties pulled from both thick and thin clients and, therefore, requires separate terminology.

CONCLUSIONS

In order to effectively communicate the requirements of a Command Post Client in the coming decade, a proper definition of such a client must be presented. Historically, the term "thin client" has loosely been applied to describe the needs of a Command Post Client. However, this term is both insufficient and incorrect. Therefore, a definition of a lightweight tactical client (LTACC) is proposed. This definition accurately describes the needs of a Command Post Client by capability rather than by conventional industry or casual terminology.

According to the qualities defined for a LTACC, the following application architectures could be considered acceptable (depending on implementation):

- A browser-based web client served through a locally hosted web server
- A native Android application
- A Windows® application downloadable via network with no installable dependencies

The following application architectures would not be acceptable:

- A browser-based client with a remote web server
- An application installed via a setup file requiring administrative access

Any client application developed for command post computing should be weighed against the qualities of a LTACC defined previously rather than an industry or U.S. Army definition of a thin client.

REFERENCES

1. Program Executive Office Command, Control, and Communications Tactical, Capabilities Production Document for Maneuver Control System, Increment 6.4, 2008.

2. Weapons and Software Engineering Center, Tactical Applications Software Requirements Specification v1.0, 2015.

3. CIO U.S. Army G6, Thin/Zero Client Computing Reference Architecture v1.0, 2013.

4. Definition of thin client, in pcmag.com, retrieved October 24, 2014 from http://www.pcmag.com/encyclopedia/term/52832/thin-client

DISTRIBUTION LIST

U.S. Army ARDEC
ATTN: RDAR-EIK
            RDAR-WSF-M,   R. Arnold
Picatinny Arsenal, NJ 07806-5000

Defense Technical Information Center (DTIC)
ATTN: Accessions Division
8725 John J. Kingman Road, Ste 0944
Fort Belvoir, VA 22060-6218

GIDEP Operations Center
P.O. Box 8000
Corona, CA 91718-8000
gidep@gidep.org

REVIEW AND APPROVAL OF ARDEC TECHNICAL REPORTS

Lightweight Tactical Client:
A Capability-Based Approach to
Command Post Computing

| Title | Date received by LCSD |

Ross D. Arnold

| Author/Project Engineer | Report number (to be assigned by LCSD) |

| X8618 | 31 | RDAR-WSF-M |

| Extension | Building | Author's/Project Engineers Office (Division, Laboratory, Symbol) |

PART 1. Must be signed before the report can be edited.

a. The draft copy of this report has been reviewed for technical accuracy and is approved for editing.

b. Use Distribution Statement A__x__, B___, C____, D____, E____, F____ or X____ for the reason checked on the continuation of this form. Reason: ____Distribution Unlimited_____

   1. If Statement A is selected, the report will be released to the National Technical Information Service (NTIS) for sale to the general public. Only unclassified reports whose distribution is not limited or controlled in any way are released to NTIS.

   2. If Statement B, C, D, E, F, or X is selected, the report will be released to the Defense Technical Information Center (DTIC) which will limit distribution according to the conditions indicated in the statement.

c. The distribution list for this report has been reviewed for accuracy and completeness.

Patricia Alameda

Division Chief   (Date)

PART 2. To be signed either when draft report is submitted or after review of reproduction copy.

This report is approved for publication.

Patricia Alameda

Division Chief   (Date)

Andrew Pskowski   12/23/15

RDAR-CIS   (Date)